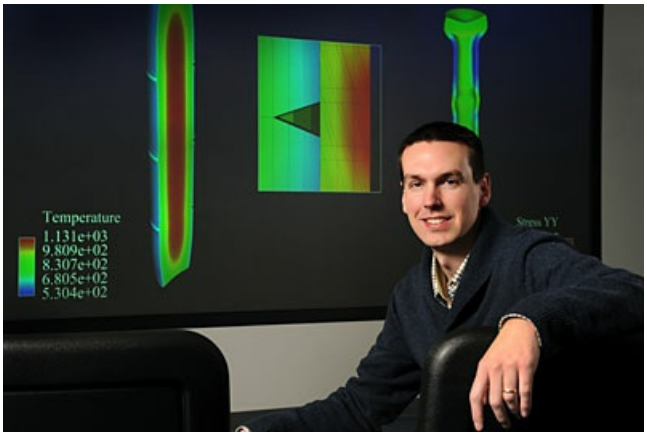


Derek Gaston's MOOSE (Multiphysics Object Oriented Simulation Environment) gives researchers a tool that could accelerate nuclear fuels experiments by years.

Young minds develop simple software to solve complex problems

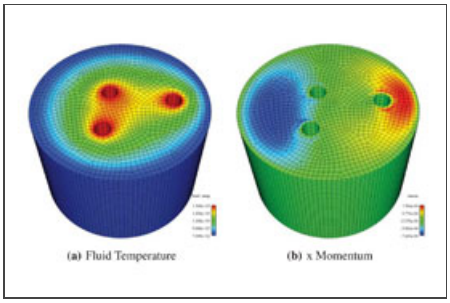
By Cathy Koon for *INL Nuclear Science and Technology Communications*

From an office in Idaho Falls, a young computer techie and his team of computer and software gurus have developed a software framework that could accelerate nuclear fuels experiments by years.

Derek Gaston, group leader for the Computational Frameworks Group in the Fuels Modeling and Simulation Department, describes his work at Idaho National Laboratory as "development of tools to enable effortless creation of high-performance engineering multiphysics simulation capabilities."

More simply, he has found a way for computers to solve equations and create simulations, thereby predicting reality and changing methods for research. It's a software program he has dubbed MOOSE (Multiphysics Object Oriented Simulation Environment).

Gaston works in the field of multiphysics and has developed tools being used by laboratories and research institutions around the country to create cutting-edge multiphysics simulation codes. His work garnered him this year's Early Career Achievement Award at the 15th Annual Idaho National Laboratory Honors Banquet. The award recognizes a high-potential individual under the age of 35. Gaston is 29, and he's been enthralled with computers since he saw his first one as a first-grader in Missouri.



Multiphysics is a complex field of study that analyzes multiple physical models or multiple simultaneous physical phenomena.

When Gaston accepted a job at INL three years ago, he was allowed the freedom to work on the concept that led to MOOSE. Multiphysics is a complex field of study that analyzes multiple physical models or multiple simultaneous physical phenomena. The resulting high-performance computing framework is being used to support the U.S. Department of Energy with future nuclear plant research, the Light Water Reactor Sustainability program, and geothermal technology programs.

MOOSE is a tool for working on many pieces of the nuclear reactor fuel lifecycle, looking at fuel fabrication and fuel performance to try to extend the life of current light water reactors while looking toward the future by simulating new reactor designs that can give cleaner, more sustainable energy. The copyrighted MOOSE is also being used in many non-nuclear settings such as environment cleanup and remediation for chemical spills, carbon sequestration and even oil shale recovery processes.

Gaston received this year's INL Early Career Achievement Award, an

Using MOOSE, simulation "is a very rapid process," Gaston said. Research that once took two to three years and a staff of leads and students can now be done in two to three weeks and six months of follow-up. For instance, a geophysicist who wanted to map the flow of water through the bedrock of the aquifer can do so in weeks instead of years.

MOOSE "minimizes the development time for creating new engineering simulations," Gaston said.

"I've put my soul into this work, and it's great to see it recognized," he said about his recent award. Being recognized for his work isn't exactly new to him. He says he has received numerous small awards for particular achievements and academic awards throughout college, "but nothing as substantial as this."

He is adamant that his team be recognized. "It wouldn't have happened without my frameworks team. It's our piece of software." He also credits his boss, Rich Martineau, for making the project possible. "None of it would have existed without him."

Gaston says nuclear engineering simulation is the hardest discipline to work in. So many different physics processes happen simultaneously, and they all impact each other, "sometimes in ways we don't expect. Capturing all of this complexity in order to provide meaningful predictions is extremely difficult."

honor he says wouldn't have happened without his frameworks team.

It is that very diversity at INL that allowed his work to be done. "The diversity is amazing," he said. "Trying to come up with a common framework for solving everything from microstructure problems to geothermal simulation keeps me on my toes." As for INL, "the best thing is the group of guys I get to work with. They are truly top-notch, and I really enjoy the incredible ideas we generate together."

Before coming to INL, Gaston worked for two years on multiphysics simulation capabilities at Sandia National Laboratories in Albuquerque. He had done an internship at Sandia and applied for a job because of the "great experience there." He was hired after receiving his bachelor's degree, and Sandia "promptly sent me to University of Texas at Austin to obtain my master's degree" in computational applied mathematics.

Gaston grew up in a small town in southwest Missouri. For his bachelor's in computer science, he went to University of Missouri in Rolla where he did several internships and co-ops. He worked for the Central Intelligence Agency in Washington, D.C., for nine months doing database work. He also worked for an automotive research firm for a number of years "which is where I got my start with engineering simulation," he said.

He plans to begin studies this fall on his doctorate.

Outside of work, Gaston turns to photography for fun and relaxation. He has around 10,000 photos stored online at www.flickr.com/photos/friedmud. His focus is landscape photography, but his online albums include family vacations, wildlife and much more. He has purchased a large-format printer to produce his own prints. He also loves skiing, hiking and playing video games.

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